Om

TEXT BOOK

on

AUTOMOBILE SERVICING & MAINTENANCE

FOR THE COURSE

OF

AUTOMOBILE ENGINEERING TECHNICIAN(+2 VOCATIONAL)

AUTHOR

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CHAPTER 1

1.Introduction

1.1 Garage, Service Station and Specialist repair shop
1.2 Tools and equipment for a garage, service station and specialist repair shop
1.3 Factors to be considered while locating service station
1.4 Layout of a typical garage, service station and specialist repair shop

INTRODUCTION

1.1 Garage, Service Station and Specialist repair shop :

Garage is a place or area where the repair and maintenance works for the automobiles will take place. It is required for trouble free operation of Automobiles for easy and prompt operation .

Service station is a place where regular and periodical maintenance works can be taken place. In Service stations periodical washings, cleaning of different parts, greasing and oiling etc., can be taken place.

Specialist repair shop is the place where special repairs and specialized reconditioning works can be taken place. This requires specialized tools, specialized and trained works etc., to attend special works like engine reconditioning , crankshaft turning, cylinder reboring etc.,

1.2 Tools and Equipments for a Garage, Service station and Specialist repair shop:

Tools and Equipments for a Garage :

1. D.E. Spanner Set
2. Ring Spanner set
3. Screw driver
4. Combination plier
5. Hand hammers
6. Sledge Hammer
7. Bench vice
8. Surface plate
9. V Block
10. Anvil
11. Grinder
12. Pulley pullers
13. Wheel Wrenches
14. Tyre Levers
15. Torque Wrenches
16. Bearing Pullars
17. Toe-in Gauge
18. Punches
19. Inside and outside Callipers etc.,

TOOLS AND EQUIPMENTS FOR SERVICE STATION:

1. Ramp or Vehicle Hoist
2. Grease cylinder
3. Grease gun
4. Air compressor
5. Car washing Machine

Along with above equipments the common tools of a garage are also needed.

TOOLS AND EQUIPMENTS AT SPECIALIST REPAIR SHOP

At specialist repair shop, in addition to the Tools and equipments of a garage, the following specialized equipments are also found available.

1. Engine Analyzer
2. Cylinder Reboring machine.
3. Crank shaft Turning Machine
4. Crank shaft grinder
5. Valve refacing machine
6. Valve grinding machine
7. Brake drum turning Lathe
8. Brake shoe riveting machine
9. Fuel Injection pump testing machine
10. Fuel Injector tester.
11. Spark plug tester
12. Ignition timing tester etc.,

1.3:Factors to be considered while locating a service station:

While locating a site for a service station, the following factors are to be considered.

1. There should be a flow of vehicular traffic in that particular region.
2. Sufficient number of vehicles should be present in that area.
3. Sufficient and properly trained personnel should be available.
4. Easy transport facility should be there
5. Spare parts and lubricants are also should be available sufficiently.
6. It should be located in busy road where all kinds of transport can be flown, particularly in Highway junction etc.

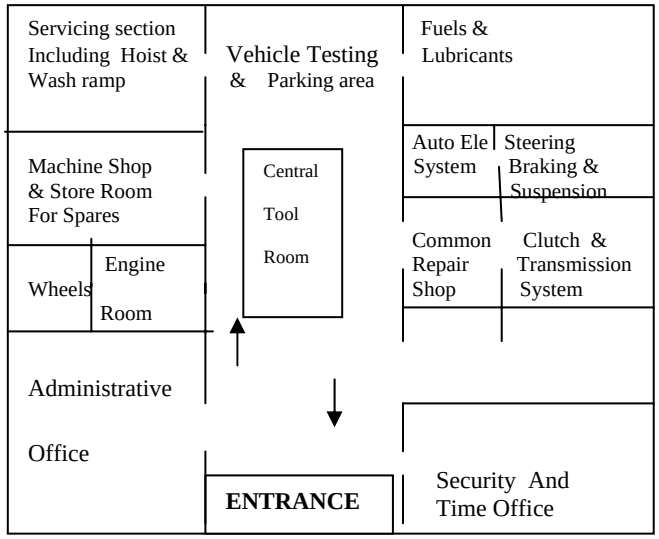
1.4:Layout of a typical garage, service station and Specialist repair shop:

For Layout of a garage the following points are to be considered.

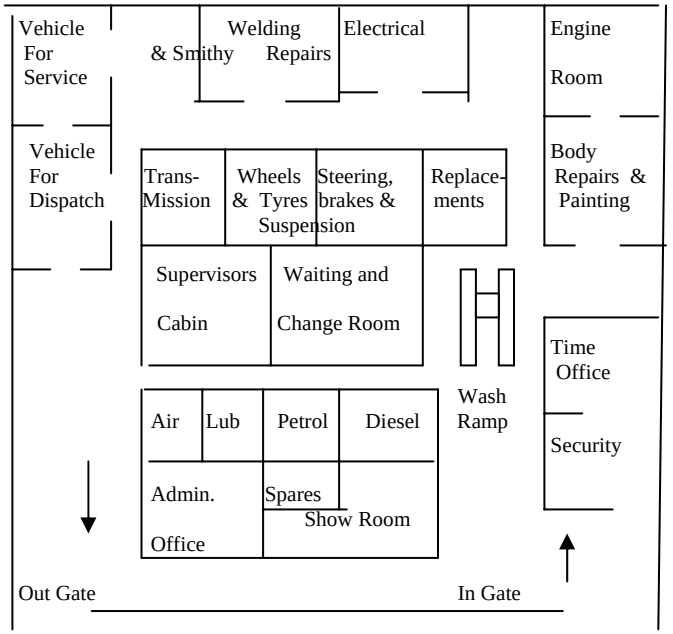
1. There should be sufficient space for moving of workers and also for easy operation.
2. The garage or service station should get proper lighting and sufficient ventilation.
3. Tools, equipments and spare parts are to be arranged in such a manner that they should be available to the worker when he wants.
4. Proper care should be taken while working on Engines and other precision equipments

5. Proper trained personnel should be available as assistants to the head mechanic.
6. Oil, grease or other such slippery materials should be cleaned off from the ground surface frequently at regular intervals.

LAYOUT OF A TYPICAL GARAGE:



LAYOUT OF A MODERN SERVICE STATION:



IMPORTANT POINTS TO REMEMBER:

1. Garage is a place where repair works can be attended to an Automobile.
2. Servicing Station is a place where Regular Maintenance and Repair works can be attended to the automobile.

SHORT ANSWER QUESTIONS:

1. What is Garage?
2. What is Service Station?
3. List out some important tools in a Garage?

LONG ANSWER QUESTIONS:

1. Draw the layout of a Garage?
2. Draw the layout of a Service Station?

CHAPTER 2

2 Major equipment for service station

Study the construction and working of the following equipment with aid of charts/original equipment

2.1 Car washing machine

2.2 Vehicle hoist

2.3 Air Compressor

2.4 Lubrication equipment- Grease guns – Hand and compressed air operated- High pressure lubrication

Major Equipments for Service Station

Mostly in Automobile Service Stations, the major and important equipments commonly used are

1. Car Washing Machine
2. Vehicle Hoist
3. Air Compressor
4. Grease drum/High pressure greasing Equipment
5. Other Lubrication Equipments etc.

Along with the above equipments, some common tools and other Miscellaneous equipments, which are mostly used in garages, are also used in Service Stations.

The Vehicle Hoist is used to lift the vehicle from ground level to a certain height so that a worker can perform a repair or maintenance work like greasing, cleaning etc., under the vehicle by simply standing. Particularly it is used when the ground clearance of the vehicle is very low.

Car washing machine is an equipment used to clean the car/vehicle in all aspects. It consists of an electrical pump, which is used to pump the water; Rubber hose pipes along with injectors for spraying of water to the vehicle.

Air compressor is used to suck the atmospheric air and store it can be used for different purposes like greasing, washing, supplying of Air, Painting, Inflation of air to the tyres etc.

The Lubrication equipments like, grease gun, Heavy duty grease guns with Air pressure, Hand and compressed grease guns etc are used in Service Station.

Car Washing Machine:

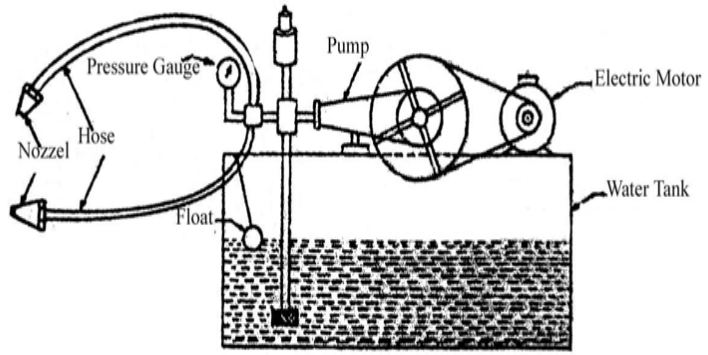
As the Automobiles are being operated in different atmospheric conditions, ie., during all seasons also, there may be deposits of Mud, dirt, dust etc, to the chassis frame, Major parts of chassis as well as to the Body also. In long run, it may be deposited strongly to the vehicle. These items cause rust to the parts of chassis. This is known as preventive maintenance.

For this reason, periodical cleaning with jet of water is needed for, which the car washing machine is used. By using the car washing machine, The spray of water with a solvent at high pressure.

The car washer consists of a pump, which is driven by an electric motor. The pump sucks water from the source of water (i.e, well, tank etc.,)

Usually two types of washers are used, one with single Hose and the other with Two Hoses. These Hoses are attached with nozzles

through which the jet of water is supplied. The water jet can be regulated by adjusting the nozzles.



CAR WASHING MACHINE

Vehicle Hoist:

The vehicle hoist is operated hydraulically. It is necessary to lift the vehicle from the ground level up to the designed height so that the Mechanic/operator can work under the vehicle.

In Automobile Workshops and Service stations, different types of Hoists are in used.

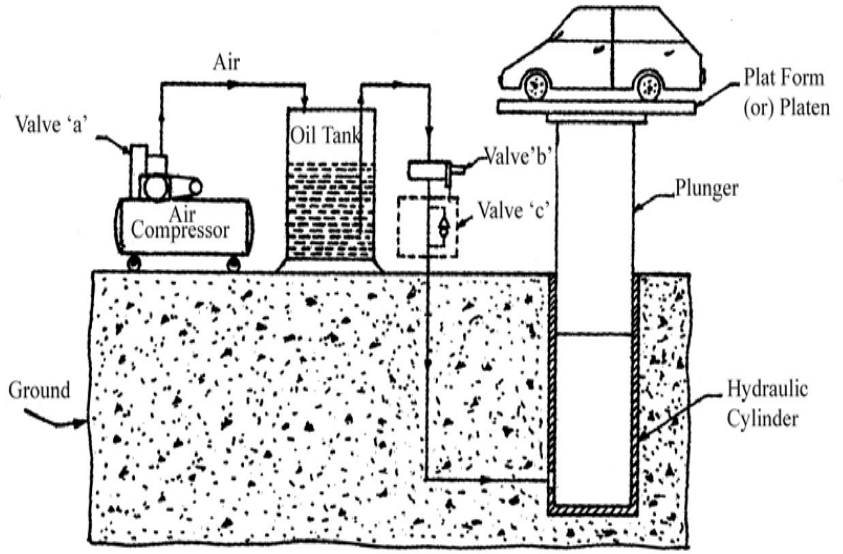
1. Single Post Hoist
2. Two Post Hoist
3. Four Post Hoist
4. Six Post Hoist etc

The hoist consists of a platform which is fixed on the top of the ram working in a hydraulic cylinder. Normally the platform will be raised with the help of hydraulic pressure applied on the ram.

The high pressure air from the compressor acts on the oil surface in the reservoir. The oil rushes through pipes in to the hydraulic cylinder via another pilot valve.

Pressurized oil entering the bottom cylinder lifts the plunger up. An automobile, stationed on platform attached to the plunger, is thus lifted up giving access for washing and servicing.

To lower the vehicle, valve is brought to the original position. Plunger descends gradually due to the weight of the vehicle. Then the oil is pushed back into the reservoir through the restriction valve.



Vehicle Hoist

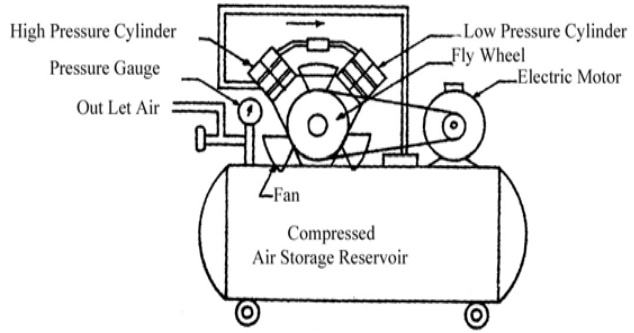
Air Compressor:

An Air Compressor is used to compress the air which can be used for different purposes like washing the vehicle, cleaning the engine, spraying Lubricating oil, spraying of paint, Air inflation into the tyres, greasing the vehicle etc.

It's working is similar to an Automobile engine. It is run by an electric motor. An automatic pressure controller is provided between the motor and main power supply line, to break the circuit, when the pressure inside the air tank reaches its maximum value.

The piston inside the cylinder of compressor draws air into it during suction stroke through inlet valve. As piston moves upward during next stroke, the inlet valve closes and the air gets compressed and

delivered to the Air tank through outlet valve. Compression gauge is provided to show the Air pressure level in the reservoir.



Air Compressor

2.4. LUBRICATION EQUIPMENTS:

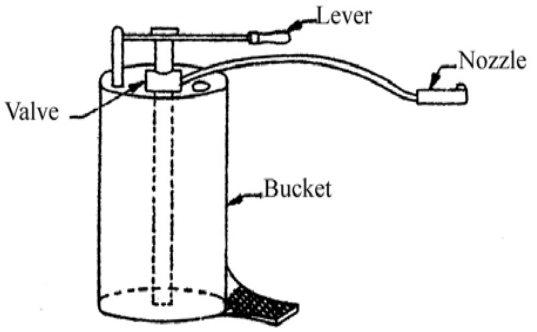
To lubricate certain components of vehicle other than engine, some external Lubrication equipments required. These are grease guns, Heavy-duty greasing cylinders, High-pressure Lubricating equipments etc.

Grease Guns:

These are used to lubricate the chassis components with grease. There are several types of grease guns. Mostly i) Push type, ii) Heavy type iii) Light type and iv) Bucket type grease guns are commonly used.

Push type grease guns consist of a cylindrical barrel, one end of which is fitted with a nozzle cup. A piston moves inside the barrel. The piston rod assemble cap is screwed tightly into the barrel. To and Fro movement of piston rod develops pressure inside the barrel. When lever is depressed grease comes out of the nozzle under high pressure.

Bucket Type grease gun valve is operated by a lever which sucks grease from the central tube and delivers through outlet valve and hand nozzle.



BUCKET TYPE GRASE GUN

High Pressure Lubrication Equipment:

It is similar to hand operated grease gun. But it is operated under air pressure. A separate container for filling of grease is arranged on compressor tank and valve is fitted on it. Grease gun pipe and Air compressor pipe are connected to valve.

IMPORTANT POINTS TO REMEMBER:

1. In an Automobile Service Station, Commonly used important equipments are:
    1. Car Washing machine
    2. Vehicle Hoist
    3. Air Compressor
    4. High Pressure greasing equipment etc.
2. Greasing equipment includes Grease guns; Grease Drum and High pressure greasing equipment which is operated under Air pressure.

SHORT ANSWER QUESTIONS:

1. What is the purpose of Air Compressor?
2. What for car washing machine is used?
3. What is the purpose of Vehicle Hoist?

LONG ANSWER QUESTIONS :

1. Explain the Car Washing Machine with neat diagram .
2. Explain the Vehicle Hoist with neat diagram.
3. Explain the Air Compressor with neat sketch.

AUTOMOBILE ENGINE RECONDITIONING EQUIPMENT

CHAPTER 3

3. Automobile Engine reconditioning equipment

Study the following processes with the help of Charts/Model/Original Compoenent

3.1 Degreasing Plant

3.2 De Carbonising

3.3 Cylinder ridge removal

3.4 Cylinder Reboring and honing

3.5 Valve seat cutting and grinding

3.6 Valve refacing

3.7 Crank shaft grinding

3.AUTOMOBILE ENGINE RECONDITIONING EQUIPMENT

Engine Reconditioning is a method of engine servicing. In this method the old and worn engines are dismantled completely, repair and reassemble all the parts, Rebuild the engine, rebore the cylinders etc., and refit the engine.

For this purpose, different types of equipments are required for reconditioning. They are cylinder reboring and Having equipments, cylinder ridge reamer, line boring machine, value reconditioning equipments, connecting rod jig, crankshaft grinder etc.,

3.1 Degreassing Plant:

A layer of oil, grease and dirt gets coated to the engine parts with passage of time and usage. The unwanted layer of grease dist etc., should be removed. This can be done by hand cleaning or by means of certain cleaning methods.

For degreasing of smaller parts, the parts are being brushed or scrubbed with a stiff bristle brush to get rid of hard deposits.

The caustic soda should not be used for aluminum alloys since it has a marked chemical action paraffin or steam bath in recommended.

In a layer workshop special chemical plant is employed to clean engine parts. Usually the dirty parts are placed in a large perforated tray or wire basket and exposed within a tank to the vapour of the heated Trichloroethylene.

3.2 Decarbonizing:

Carbon is deposited in the cylinder due to rich mixture supply, use of wrong grade oil, unnecessary idling, too much oil, poor fitted piston and piston rings.

Deposition of carbon causes Engine knockings, missing of explosion and burnt value resulting in loss of power.

These are in general three methods of decarbonizing or decoking.

1) Scrapping method
2) Oxygen decarbonizing method
3) Chemical method of decarbonizing

i) Scrapping method :

The scrapping of the carbon is done by hand scrapping with the help of tools. To remove the carbon quickly, carbon removing brushes may be fixed in the chuck of an electric portable drill. To clean valve grinder, valve stems etc., special wire brushes may also be used.

ii) Oxygen De-carbonizing method:

It is the process of removing carbon from the inside of the cylinder and head of the piston without removing cylinder head by means of an oxygen flame. The equipment consists of an oxygen tank fitted at an initial

pressure of 156 kg/cm² and an adjustable reducing valve for bringing the pressure down to 0.7 to 1.4 kg/cm².

The oxygen is applied to the combustion space by inserting a flexible delivery jet through a valve by slightly bending it. The oxygen flame will burn away all the carbon deposits completely.

iii) Chemical Method of De-carbonizing:

A special chemical is injected into the spark plug or injector hole in liquid form. The engine should be in warm condition so that the liquid can act more efficiently. After twelve hours the carbon in loosened, so that upon starting the engine it is blown out of the exhaust pipe.

CYLINDER RIDGE REMOVAL:

Ridge is the excess material of the cylinder at the upper limit. It should be removed while servicing the cylinder. Otherwise it may cause damage to the piston rings while removing piston from the cylinder.

The ridge is removed by means of special ridge reamer.

The ridge cutter consists of column, spindle head, cutter and level table. The cylinder block is placed over the table below the spindle.

The cutter is centered and then speed and feed is given to the ridge reamer while starting the machine. The downward motion of the spindle is applied.

RECONDITIONING OF CYLINDER:

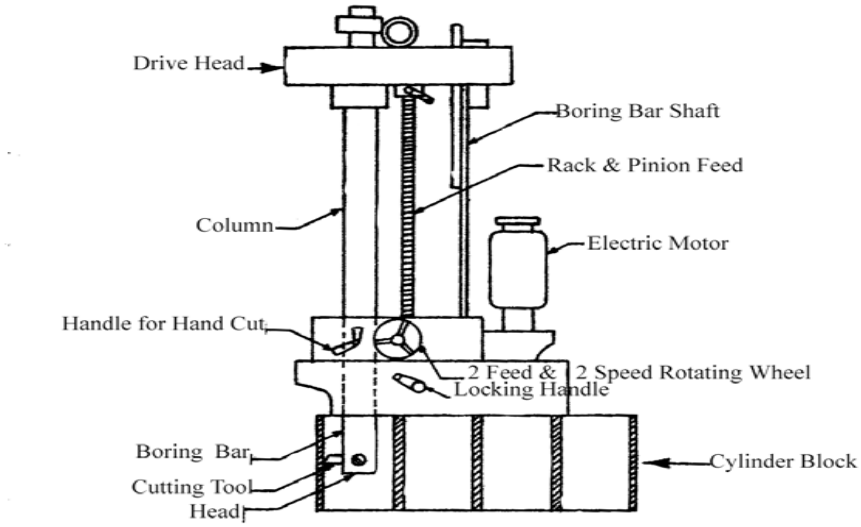
After prolonged usage of the engine, the cylinder of the engine will get maximum taper wear and ovality wear. The Taper and Ovality wear will occur only after 40000 to 60000 kms run.

Generally the maximum permissible ovality is specified as 0.01 mm and taper as 0.25 mm. Cylinder bores with less than 0.01 mm Ovality need not be rebored. They should only be Honed.

CYLINDER REBORING:

Reboring is done by the reboring machine in which a single point cutter which is set to exact diameter required with special micrometer. The cutter blade shaft is mounted inside a column which moves up and down its housing in the fixed part of the machine for tool feeding purpose.

The top surface of the cylinder block is thoroughly cleaned and the boring bar set at one of the cylinder bores. After completing boring the cylinder must be washed thoroughly to remove all abrasive particles.



CYLINDER REBORING MACHINE

CYLINDER HONING METHOD:

After Reboring, Honing is required to finish the bore to smooth finish. It removes minor imperfections and glaze. A hone consists of four or six narrow, narrow graded grinding stones mounted in cage around a spindle which rotated by an electric motor.

Place the Hone in the cylinder and expand the stones until the assembly can jest be turned by hand and machine started. Move the Hone up and down slowly with the first cut rough Hone up and down slowly with the first cut rough stones, but more rapidly with the finish cut five stones.

VALVE SEAT CUTTING AND GRINDING:

At every 7 overhauling of engine, valve seats should be inspected carefully. Due to using of poor quality of fuels and etc., the valve seats may become pitted, get more wide etc. By cutting the valve seat and grinding, this problem may be rectified.

The valve seat can be cut by valve seat cutter. The valve seat cutter fitted on the valve seat and to the valve guide. The tool is rotated by hand by means of sliding handle providing at the top.

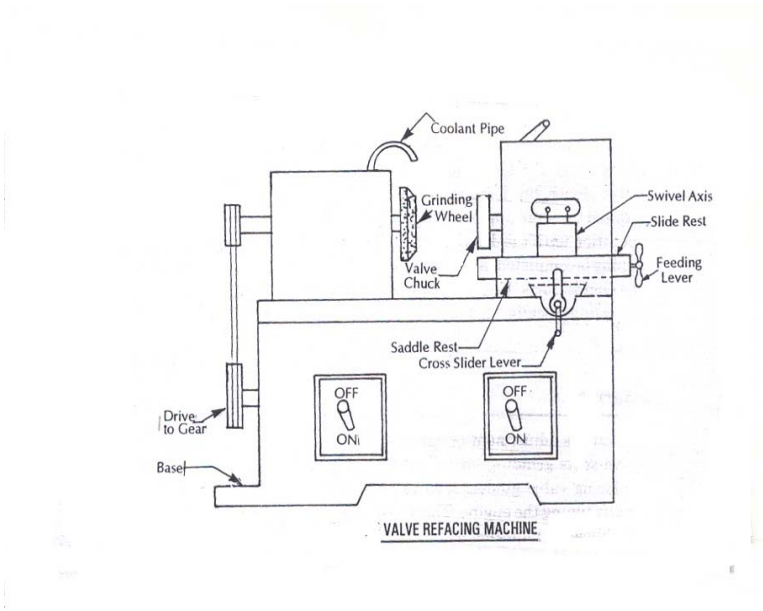
GRINDING VALVE SEAT:

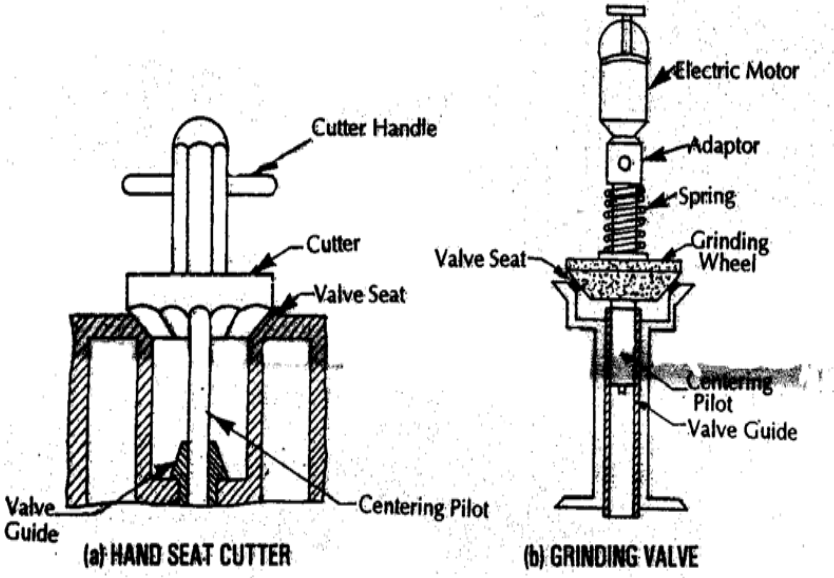
For proper seating of valve on the valve seat, the seat should be grinded thoroughly by either valve grinding machine or valve grinding stick. This enables the valve to sit properly into the valve seat so that no leakage of either fresh charge or burnt gases will be there as the case may be. During grinding coarse and Fine grinding paste will be applied between the valve seat and valve face.

VALVE REFACING:

This process is done by a machine known by its name. This machine consists of a grinding wheel operated by an electric motor. The valve is held in chuck which can be moved at any angle. It should be the valve seat angle.

Put the valve into the chuck and tighten it. Move the face of the valve across the valve grinding wheel.

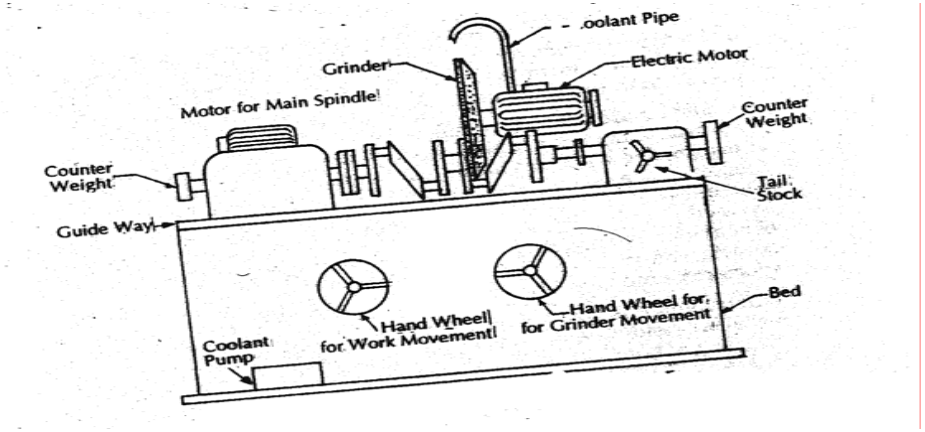




CRANKSHAFT GRINDING:

It is grinding of Main journals and Big end journals of crank shaft. It is done by crankshaft grinder. This machine consists of a bed on which guide ways are provided. Head stock and Tail stock are provided on both ends. By using a hand wheel in front of the machine, the Head and Tail stocks are moved. A big grinding wheel is provided at the back of the machine. It can be moved forward and backward by a hand wheel.

The crankshaft is mounted in between the chuck and the dead center. The job is centered with spindle axis. Adjust the spindle and grinding wheel accordingly and grind the journals of crankshaft.



CRANK SHAFT GRINDING MACHINE

IMPORTANT POINTS TO REMEMBER:

1. Engine Reconditioning is a Process of Total Engine Servicing to make it as a new one with good performance.
2. Degreasing is the process of removing unwanted Layer of grease on the parts which was created due to passage of Time.
3. Removal of Carbon from the wall and Heads of Cylinders is known as De carbonising.
4. The Carbon is deposited due to rich mixture of idling, too much oil, poor fitted pistons and their rings.
5. De carbonizing methods:
   i) Scrapping Method ii)Oxygen De Carbonizing iii) Chemical De Carbonizing

SHORT ANSWER QUESTIONS:

1. What is the degreasing?
2. What is de carbonizing?
3. What is necessity of Valve refacing?
4. What is Crank shaft grinding?

ESSAY TYPE QUESTIONS:

1. Explain the cylinder reboring process?
2. Briefly explain the Crank shaft grinding?

CHAPTER 4

4. Reconditioning of Brakes

Study the construction and working of the following equipment with aid of charts/model/original components

4.1. Brake drum lathe

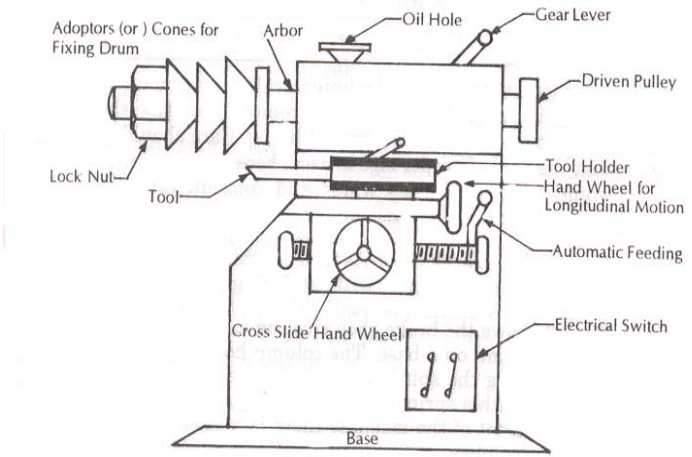
4.2. Brake shoe riveting

RECONDITIONING OF BRAKES:

INTRODUCTION:

After prolonged usage of brakes, the brake shoes get worn out which may lead to slipping of brakes and even the brake shoe rivets touch the brake drum and damage it. The common defects are I)Scored drum, ii) Barrel shaped drum, iii)Bell mouth drum, iv) Tapered shaped drum. Under such circumstances these should be get turned on Brake drum lathe before refitting.

BRAKE DRUM LATHE: The brake drums are subjected to wear after prolonged usage. These drums must be turned for smooth and regular surface. Most of the drums can be turned out to 0.06 inches over size and over size lining is used.



BRAKE DRUM LATHE MACHINE

The Brake drum lathe machine consists of a base in which drive mechanism for the spindle is arranged. The Brake drum is mounted on the spindle and is locked with the help of lock nut. Cutting tool is fixed in the tool post. After two to three turns, switch off the machine and check for the parallel ness of cuts. If they are parallel, continue the turning. Depth of cut adjusted with the
help of cross feed hand wheel. The cutting operation continued until the required diameter is

obtained for the drum. There should not be any excess removal of metal from the drum.

BRAKE SHOE RIVETTING: After long usage the brake linings will get worn out. For replacing brake shoe linings, the new linings should be riveted on the brake shoe after removing old linings. For proper riveting, Brake shoe riveting machine is used.

Brake shoe riveting machine is provided with a column on a base. In front of the base a foot pedal is provided with a spring. Riveting rod is operated with foot pedal. At the side of the machine, grinding wheel is arranged for counter sinking of brake shoe and for finishing the high spots.

SHORT ANSWER QUESTIONS:

1. What is the purpose of Brake drum lathe?
2. What is the necessity of Brake shoe riveting?

ESSAY TYPE QUESTIONS:

1. Explain the turning of Brake drum on Brake drums lathe.
2. Briefly explain the Brake shoe riveting.

CHAPTER 5

5. Reconditioning Diesel Fuel injection system

Study the following test procedures with the help of chats/models/original component

5.1 Fuel injection pump test bench (phasing and calibration tests)
5.2 Fuel injector testing

RECONDITIONING DIESEL FUEL INJECTION SYSTEM.

TESTING OF FUEL INJECTION PUMP: It is required for proper operation of fuel Injection pump at the time of installation or periodical maintenance.

Testing of fuel injection pump is of Two types.

i) Hand operated test bench
ii) Motor driven test bench.

On hand operated machine, the pump is calibrated at limited speeds, thus also do not perform the governor test.

The motor driven bench consists of an electric motor of 2 to 3 H.P. Therefore the operating range of the pump can be obtained upto4000RPM . The machine has provisions to connect the pump at right alignments. A flexible coupling is provided to connect the shafts. A trip plate is provided which trips off at every 14 seconds.

The delivery pipes from the pump are connected to the injection nozzles which are having spring loaded valves. The fuel delivered from the nozzle is measured by the glass vessels.

By this test, the quantity of the fuel delivered from the nozzle is measured.

Phase angle test: It is used to check the interval between successive injections.

(i) The rack is set to position using a pump rack setting device. The delivery valve and spring are removed from No 1 element and the test pipe connected to this element.
(ii) Tappet adjusting screw, tappet pads or phasing shims should be altered to provide small clearance usually from 0.6 to 1 mm .
(iii) The Pump cam shaft is rotated by hand until element No.1 is at the bottom of its stroke. A Valve on the test bench is opened to allow fuel to flow out of the test pipe. This is long spill .
(iv) When the flow closes the angle should be noted
(v) Continue this process on all the injectors .

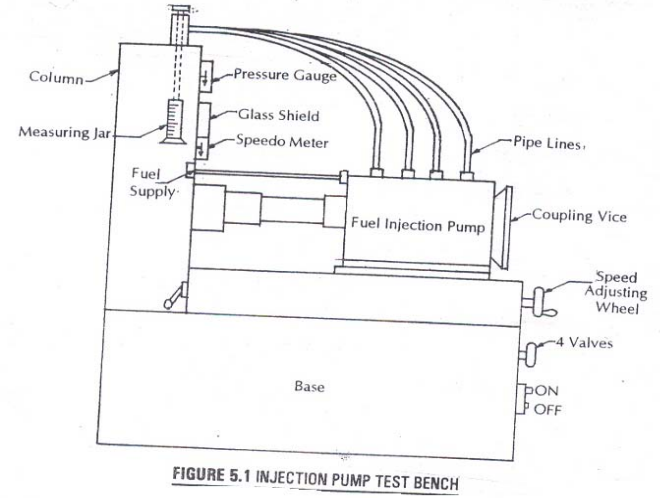


FIGURE 5.1 INJECTION PUMP TEST BENCH

CALIBRATION:

This system consists of adjusting is element to deliver an equal quantity of fuel to the cylinders . The sequence of this operation is as follows .

i) Mount and couple the injection pump with pump calibrating machine .

ii) Set the control rod to the position of about 5 Mm in rack

iii) Make all the connections of fuel pipe lines at inlet and outlet of pump elements without any leak.

iv) Operate the machine and run the pump at 600 rpm and bleed the system by opening the air vent cock

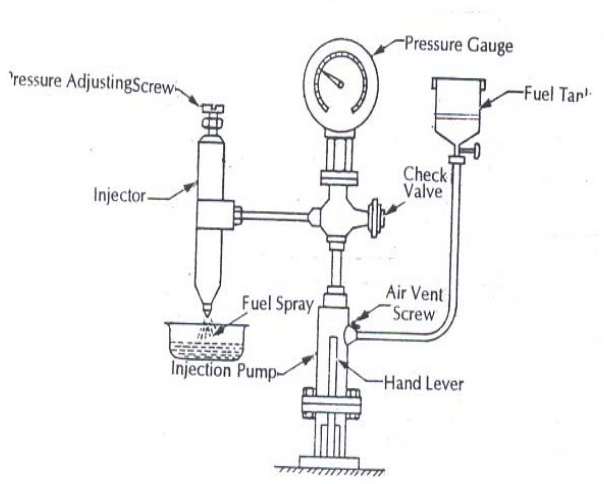
v) Continue this process according to the recommendations of manufacturers .

INJECTOR TESTER:

With injector tester the nozzle of injector is tested and calibrated as per the working pressure of the injection system. The working pressure and the nature of the spray can be studied .

It is a kind of hand operated pressure pump which consists of a fuel tank from which the fuel is fed to the injector . The Pump is operated manually by means of a hand lever. A pressure gauge is connected to the pressure pipe which is provided with a shut off coke . An air vent screw is provided to release the air from the tester. When hand lever is operated, the fuel pressure is developed inside the pump and the pressure pipe there by spraying the fuel from nozzle of the injector .

By using Injector tester, the tests conducted on Injector are
I) Pressure test II) Leak off test III) Spray test.



INJECTOR TESTER

Points to Remember :

1. Testing of fuel injection pump is required for proper operation of fuel Injection pump.
2. Phase angle test is used to check the interval between two successive injections .
3. Calibration is adjusting of each element to deliver equal quantity of fuel.

SHORT ANSWER QUESTIONS:

1. What is calibration?
2. What is the purpose of testing injector?
3. What is phase angle test?

ESSAY TYPE QUESTIONS:

1. Briefly explain the testing of fuel injection pump
2. Explain the step by step process of Calibration
3. Explain the testing of injector

CHAPTER 6

6. Servicing and Maintenance

6.1 General procedure for servicing and maintenance of Motor Vehicles
6.2 Types of maintenance – periodic maintenance – break down maintenance – preventive maintenance – operation maintenance
6.3 Type of servicing- cleaning of the motor vehicle and its components – greasing of motor vehicle

6.1 : General Procedure for Servicing and Maintenance of Motor Vehicles:

The Servicing and Maintenance is required for Automobiles for their trouble free performance and also for prolonged life of Vehicles. The general procedure of servicing and maintenance include Periodical checking of I) Engine oil level ; ii) Battery condition ; iii) Performance of cooling; iv) Performance of Lubrication V) Condition of Tyres & Tubes Vi) Suspension system Vii) Braking System Viii) Steering geometry ix) Transmission system etc.

6.2 : Types of Maintenance:

There are four types of Vehicle Maintenance:

1. Preventive Maintenance
2. Breakdown Maintenance
3. Periodic Maintenance or Scheduled Maintenance
4. Operation Maintenance

6.2.1: Preventive Maintenance:

For Prevention of Break down of Vehicle or without giving any trouble on road, some kind of attention on maintenance should be taken which is known as Preventive maintenance. It includes the advantage like

i) Reduces the chance of Break down of vehicle
ii) Increased safety due to reduced Breakdown
iii) Lesser Expenditure on repairs
iv) Good control on inventory of spare parts etc.

6.2.2 : Break down Maintenance :

Break down maintenance is the attention provided to the vehicle when a vehicle becomes immobilized due to faults created during running. These include starting difficulty, Puncture, electrical faults, faults in fuel supply system, overheating of engine, Breakage accidents etc.

6.2.3: Periodic Maintenance:

Periodic Maintenance or Operative maintenance is provided to vehicle after certain period of operation or run of certain kilometers. This kind of maintenance may be done daily , weekly, quarterly, yearly or after covering every 500 Kms, 1000 Kms,2000 Kms, 4000 Kms etc. By doing periodic maintenance, major Breakdown may be prevented.

6.2.4: Operation Maintenance:

Daily Maintenance by the operator for proper running of the vehicle is known as operation maintenance. It is necessary to keep the vehicle in proper working condition. It includes Tyre inflation , Battery checking , clutch and Brake adjustments, checking of Starting, Ignition and Lighting systems etc.

6.3 **Types of Servicing:**

Different Types of Servicing required to maintain the Vehicle. The Servicing of motor vehicle is of following Types.

1) Cleaning of Motor Vehicle and its parts
2) Inspection and repair of different parts
3) Adjustments
4) Greasing and Lubrication

6.3.1 Cleaning of Motor Vehicle and its Parts:

A Layer of oil, grease and dirt gets coated to the motor vehicle and its parts with passage of time and usage. Before servicing of the vehicle, the unwanted Layer should be removed. This can be done by hand cleaning or by means of certain cleaning methods. Hand cleaning seems to be cheap but most expensive in terms of wasting of valuable time of a skilled worker.

The cleaner equipment greatly influence the speed, thoroughness and economy of the cleaning operation. The cleaner may be operated at room temperature. Most common methods of cleaning automobiles and its parts are Steam cleaning; Water pressure Cleaning; Solution cleaning; and Vapor bath cleaning.

Greasing of Motor Vehicle:

Greasing of Motor vehicle involves Seven main operations:

1. Engine Lubrication
2. Chassis Lubrication
3. Rear Axle and Differential Lubrication
4. Transmission Lubrication
5. Universal Joint Lubrication
6. Steering Mechanism Lubrication
7. Lubrication of Springs.

Points to remember:

1. The servicing and maintenance is required for Automobiles for trouble free performance.
2. It includes 4 types of maintenance 1. Preventive maintenance 2. Break down maintenance 3. Periodic maintenance 4. Operation Maintenance

SHORT ANSWER QUESTIONS:

1. Mention the types of Vehicle Maintenance?
2. What are the types of Servicing?

ESSAY TYPE QUESTIONS:

Briefly explain the types of maintenance.

CHAPTER 7

7. Servicing and maintenance of two wheelers

7.1. Maintenance and its role in trouble shooting of two wheelers- advance of good maintenance

7.2. Daily, weekly and monthly maintenance or after every 2000 Km- General and periodical Check up – Servicing

7.3. Adjustments, dismantling, assembling and trouble shooting of Bajaj, Hero Honda, TVS, Yamaha Two Wheelers.

7.1 Maintenance and its role in trouble shooting of Two Wheelers:

The routine maintenance, the day to day adjustments and minor repairs required by all the vehicles and major overhaul of a 2 Wheeler are quite different although each of them is to keep the Vehicle in good working order.

The best way of preventing troubles in 2 Wheelers, is the constant and systematic inspection. The fault finding should be methodical and systematic.

Proper maintenance increases trouble free running to the vehicle longer period of time.

Advantages of good maintenance:

1. Good maintenance reduces the breakdown of the Vehicle.
2. It increases safety due to reduced breakdown
3. The expenses of repairs will be minimized.
4. It increases the running life of the vehicle
5. It obtains maximum performance.

Daily Maintenance:

a) Check fuel level, refill it if necessary
b) Clean the vehicle completely
c) Check the tyre pressure when tyre is cold
d) Check whether all lights, horn and other switches are working properly
e) Check the breaks, and cables of clutch and break.
f) Check the wheel nuts.

Weekly Maintenance:

a) All the Daily maintenance tips should be followed at first.
b) Thoroughly clean the vehicle with water for keen inspection.
c) Check and top up if necessary the gear box oil level.
d) Tighten the shock absorber bolts and nuts.
e) Adjust the Brakes.
f) Tighten and Lubricate the chassis joints, bolts chain, handle steering bolts etc.
g) Check the Ignition System.
h) Clean the Air cleaner.

Monthly Maintenance:

After every 2000 Kms of run or after a month, the following checking are necessary for a Two Wheeler.

a) Check the Oil level in gearbox and top up if necessary.
b) Check the clutch and adjust it.
c) Check the gap of Spark plugs and adjust.
d) Check the Condition of belt and replace if necessary.
e) Lubricate all the parts like cable ends, gear suspension levers, clutch and brake levers, Handle bar bottom bearing, wheel bearing etc.
f) The 'Carburetor' should be dismantled, cleaned, checked and refilled thoroughly.

GENERAL and PERIODICAL CHECK UP and SERVICING:

For Two Wheelers the general and Periodical Check ups are needed and also servicing at regular intervals, so that they will give good and Trouble free performance.

The Servicing is also should be done as per the Weather conditions also. By doing periodical checkups to the vehicle we may Prevent a major Trouble there by minimizing the repairing expenditure.

COMMON TROUBLES IN VARIOUS FIELDS OF TWO WHEELERS:

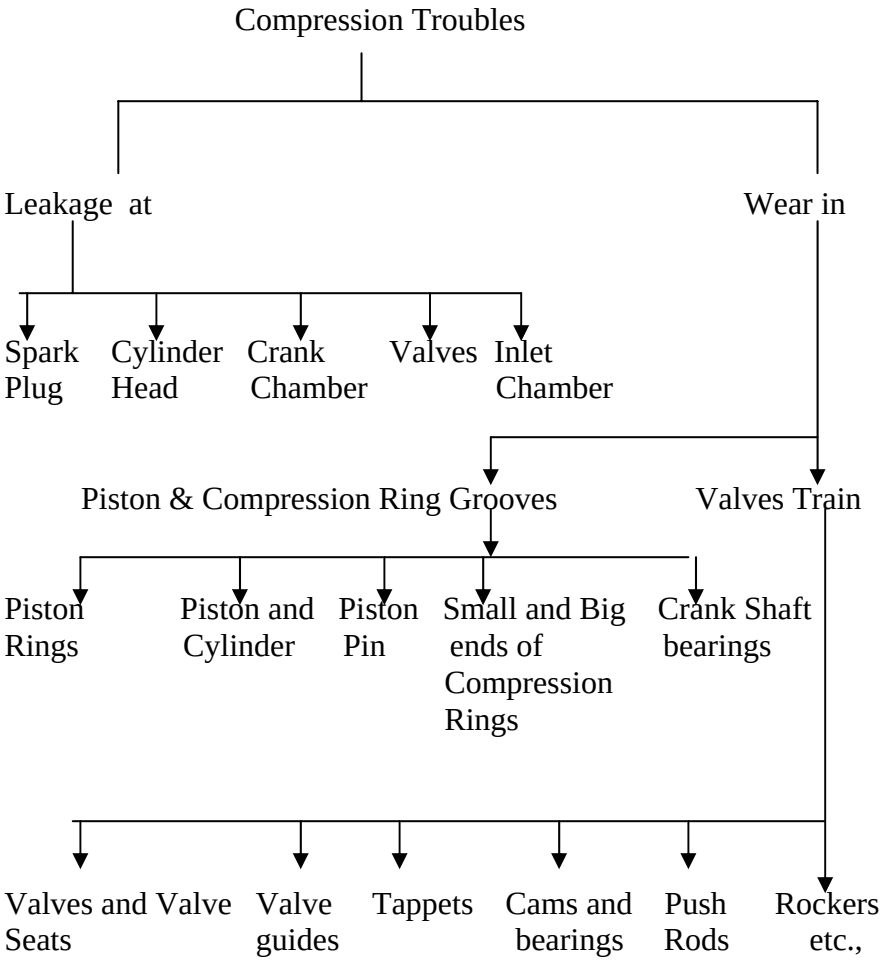
A motor cycle or Scooter can be split up into the following main fields with regard to its working and construction.

a) Engine b) Transmission and Brakes C) Frame, Suspension and steering d) Charging, Lighting and Horn.

Each main field could be further divided into the following Sub fields :

a) Engine (Development of Power) :
    I. Carburation
    II. Ignition
    III. Compression depending upon Lubrication, cooling and operation of engine parts.
b) Transmission and Brakes:
    i) Clutch ii) Gear Box iii) Drive line(Chains & Sprockets; Gears and Shafts iv) Brakes
c) Frame, Suspension and Steering:
    i) Frame and Suspension
    ii) Steering
d) Charging, Lighting and Horn:
    i) Charging System ii) Lighting System iii) Horn System

Compression Trouble chart in Two Wheelers:



Transmission and Brakes:

Usual Transmission Troubles are as under:

1) No Power Transmission
2) Slipin Power Transmission
3) Noise in power Transmission
4) Difficulty in power Transmission

The Common Troubles of Brakes are

1) Poor Brakes
2) Uneven Brakes
3) Hard Brakes
4) Noisy Brakes
5) Slipping of Brakes

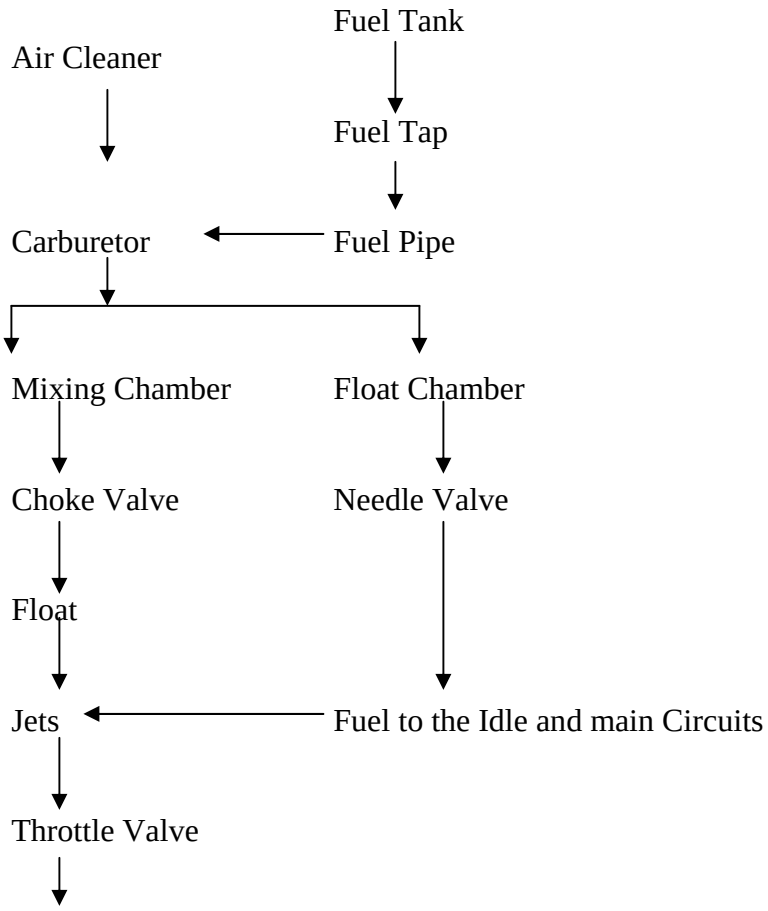
Usual Troubles in Electrical System are

1) No power supply to the Ignition
2) No power supply to the Lighting and Horn etc

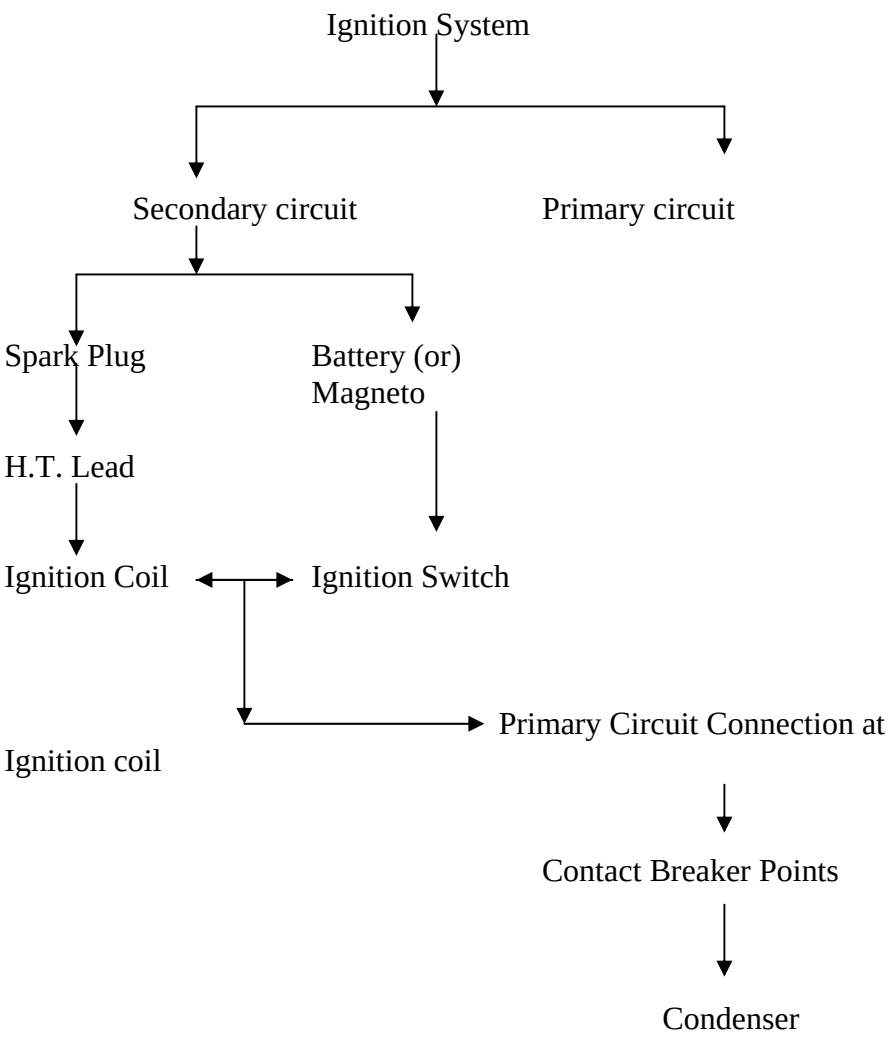
Common Troubles in Carburation:

1) Over flow of Carburetor
2) Supply of lean or rich mixture during Idle and Low speeds or Medium and High speeds.
3) More or Less fuel supply during same throttle opening.
4) Restricted fuel supply during Idle, Low, medium and High speeds.

Checking of fuel system in a Two Wheeler can be summarized as:



Checking of Ignition System:



Technical Specification of 2 - Wheelers

Model	Engine Displacement(CC)	Power (h.p)	No. of gears Variator	Fuel Consumption kpl	Kerb Weight in Kg	Year of manufacturer
BAJAJ						
1.Chetak	145.55	7.5	4	60	94	1971
2. Super FE	123.67	6.66	4	60	89	1993
3. Classic	145.55	7.5	4	75	NA	1994
4. M80	76.3	4.5	3	60	78	NA
5. Kawasaki KB	99.97	11	4	60	110	1986
LML VESPA						
NV Special	149.5	8	4	NA	104	1984
TVS						
TVS 50XL	50	2	1	68	59	1981
Champ	59.9	2.4	1	65	62	1990
TVS Suzuki	98	10.5	4	65	100	1980
KINETIC						
Luna Super	49.8	1.7	1	70	51	1972
Safari	58.2	Na	V	70	77	
Kinetic Honda	98.81	7.7	V	60	99	1985
HERO						
Hero Majestic	1.9	49	1	75	55	1978
ENFIELD						
Silver Plus	50	2.6	3	75	71	1984
Bullet 500	499	22	4	35	168	
HERO HONDA						
CD 100	97.2	7.5	4	90	95	
ESCORTS						
Rajdoot	173	9	3	50	114	1960
Yamaha	98	11	4	45	95	1980

POINTS TO REMEMBER:

A Two wheeler can be split up into the main fields with regard to its working and construction a) Engine b) Transmission and brakes c) Frame suspension and Steering
d) Charging lighting and horn.

SHORT ANSWER QUESTIONS:

1. What are common troubles that occur in operation of a Two wheeler?
2. What are the reasons for Carburetion trouble in a Two wheeler?

ESSAY TYPE QUESTIONS:

1. Briefly maintenance of a Two Wheeler
2. Explain the trouble shooting for not running of Engine in a Two Wheeler

CHAPTER 8

8. Servicing and Maintenance of 3 Wheelers

8.1. General and periodical maintenance of 3 Wheelers
8.2. Adjustment , dismantling, Assembling and Trouble shooting of Bajaj and APE three wheelers

8.1 **INTRODUCTION**: The Automobile 3 Wheelers are usually used as passenger Vehicles and also as cargo vehicles particularly in the urban areas. By using the 3 Wheeler, the time will be saved and also the Transport only 2 Stroke petrol engines were used in 3 wheelers. But now a days both 2 stoke and 4 stoke petrol and diesel engines are also used in 3 wheelers.

8,2 **General and periodical Maintenance of 3 Wheelers**:

For periodical Maintenance of 3 Wheelers, the following fields are to be Checked.

a. General Servicing
b. Cleaning of Air cleaner element
c. Tyre Rotation
d. Replacing of oil filter element
e. Checking and Adjusting of Valve clearance
f. Checking of electrolyte in Battery
g. Checking of Injector (in case of Diesel engines)
h. Checking of Spark plug (in case of Petrol engines)
i. Control cables, Brake, Clutch and other adjustments
j. Hydraulic Brake bleeding etc.

PERIODIC MAINTENANCE CHART OF BAJAJ 3 WHEELER:

Recommended ODOMETER READING in Kms.

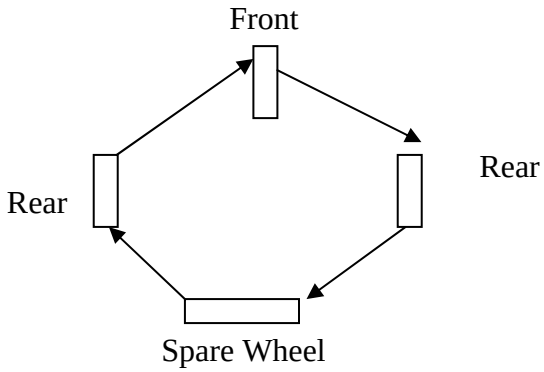
Sl No	Operation	1000	5000	10000	15000	20000	25000	30000
1	Servicing	OK	OK	OK	OK	OK	OK	OK
1	Clean Air Cleaner Element	OK	OK	OK	OK	OK	OK	OK
2	Tyre Rotation (Every 100000 Kms)			OK		OK		OK
3	Replace Oil Filter Element	OK	OK	OK	OK	OK	OK	OK

4	Check and Adjust Valve Clearance	OK	OK	OK	OK	OK	OK	OK
5	Check electrolyte Level in Battery (Every Fortnight)	OK	OK	OK	OK	OK	OK	OK
6	Check the injector For Pressure and Spray Pattern					OK		
7	Control Cables, Clutch Brake Pedal adjustments	OK	OK	OK	OK	OK	OK	OK
8	Bleed Hydraulic Brake System	OK	OK	OK	OK	OK	OK	OK
9	Check Front/ Rear shock Absorbers	OK	OK	OK	OK	OK	OK	OK
10	Fork Assembly Adjustment		OK	OK	OK	OK	OK	OK
11	Checking of Pipes				OK			OK

For Proper Maintenance of a 3 Wheelers, the following Points to be considered.

1. Clean the Air Cleaner element and replace the filtering element thoroughly.
2. Use correct grade and quality of engine oil, Gear Box oil, and also Differential oil
3. Use the recommended Brake fluid. Remember that the Brake fluids of Different companies should not be mixed.
4. Always inflate the recommended Air pressure in the tyres.
5. Check and Ensure that the electrolyte level is between the Upper (Max) and Lower (Min) level in each cell.
6. Only Distilled water should be filled up the electrolyte level in the Battery.
7. The following are the Daily checkups for a 3 Wheeler.
   i. Fuel – Ensure that there is enough fuel and there is no leakage in any pipe lines.
   ii. Engine Oil - Check engine oil level daily Check oil tubes for cracks and Replace them.
   iii. Check Low oil Pressure indicator Lamp ; battery Charging Lamp etc.
8. Check Brakes for effectiveness
9. Check tyres for correct inflation etc
10. The tyre Rotation should be done for every 10,000 Kms. Always the best tyres Should be kept at Rear portion as they are driving wheels.

Tyre Rotation:



ESSAY TYPE QUESTIONS:

1. Briefly explain the Maintenance tips of a Three Wheeler

CHAPTER 9
SERVICING AND MAINTENANCE OF FOUR WHEELERS

9. Servicing and Maintenance of Four Wheelers

Dismantling, over hauling and reassembling of the following units of the Maruthi, Ambassador, Santroi, Toyota Qualis, Indica

9.1. Engine
9.2. Fuel System
9.3. Lubrication System
9.4. Cooling System
9.5. Transmission System
9.6. Ignition System
9.7. Steering, brakes and suspension system
9.8. Testing the engine with the help of engine analyzer
9.9. Alignment of wheels
9.10. Balancing of Wheels

SERVICING AND MAINTENANCE OF FOUR WHEELERS

INTRODUCTION:

Servicing and Maintenance of Four Wheelers plays a major role in Transportation of Now-a-days. There are different types of Four Wheelers . Those are namely Cars, Jeeps, Buses, Trucks etc.

For Maintenance of 4 Wheelers, there are different ways of servicing different parts namely Engine, Clutch, Transmission, Cooling & Lubrication, Steering, Suspension, Braking System, Wheels & Tyres etc should be attended.

SERVICING OF ENGINE:

For Servicing of an Engine, the following points are to be attended.

1. Cleaning the Engine, Reconditioning of Engine by Valve Servicing, Cylinder reboring, Crankshaft turning etc.
2. Servicing of Cooling System
3. Servicing of Lubrication System
4. Servicing of Fuel Supply System etc

Servicing of Engine includes valve Refacing, valve grinding Crank shaft Turning are to be attended.

Crank shaft Turning :

During Long Run, the crank shaft wears unevenly. This causes uneven wear

In Main and Big end journals of Crankshaft. This leads to uneven sitting of crank shaft in to the crank chamber and also irregular alignment of connection Rods.

To avoid this the crankshaft should be turned in Crankshaft Lathe.

Cylinder Reboring and Honing:

During running, the piston touches the cylinder very rigidly and sharply which leads to irregular wear of cylinder very rapidly. The may lead to leakage of fresh charge and also compression leak. To avoid this, The cylinder should be rebored . After Reboring, as the diameter of cylinder increases, oversize piston should be used.

Valve Refacing and Valve grinding:

These are required for proper sitting of Valves. This is essential for correct Refacing and grinding as such there should not any leakage.

For better performance of Engines, the engine should be thoroughly cleaned of Carbon contents etc.

Servicing of Fuel System:

A. Servicing of Fuel system of petrol engines:

For Servicing of Fuel System of petrol engines, the components to the inspected are

a. Fuel Pump (Mechanical or Electrical)
b. Carburetor
c. Air Cleaner.

a) **Servicing of Fuel Pump**: Generally the repairs in this part are limited only Small replacements are needed in check valves etc.
b) **Servicing of Carburetor** plays an important role in Servicing of Fuel System. If there is any problem in Float System of Carburetor, the Float or Float pin etc. are needed to be replaced. The gaskets or packings of carburetor needed to be changed. The jets are also needed to be replaced.
c) **Servicing of Air Cleaner** is needed for proper entrance of Air through it. It is required if there are dust and dirt particles present. The Air cleaner needed to the cleaned and the filtering element is needed to be replaced.

B. Servicing the Fuel System of Diesel Engines:

Servicing of Fuel System of Diesel engines includes Servicing of F.I. Pump, Injected, Bleeding of Air from the fuel pipe lines.

For Servicing of Fuel injection pump, the pump is needed to be checked for proper timing by adjusting the governor and also the F. I Pump is needed to be checked for proper adjustment of pressure and timing.

The injector is needed to be checked for its spray timing and pressure.

Servicing of Lubricating System:

While Servicing lubricating System the following points to be considered. These are

i. Excessive Oil Consumption
ii. Low Oil pressure

(i) **Excessive Oil Consumption**:

It is the most common trouble As the parts wear, engines use more and more oil. New engines or newly over handled engines can use excessive quantities of Engine oil. There are four cases of excessive Engine oil Consumption.

a) In Case of New Engines
b) In Case of Old Engines

c) Crank case dilution

d) Oil leakage

For Servicing of Lubricating System the following pints and also to be considered.

Cleaning of oil filter, checking of oil pump, etc.,

(ii) **Low oil pressure**:

If the oil pressure is low, the oil film between the mating parts will become thinner and the quality of Lubrication will be deteriorated. To avoid this the oil pump is to be checked for proper pressure.

Servicing of Cooling System:

The common problems in cooling system are:

- Overheating of Engine
- Engine fails to warm up
- Loss of coolant

To overcome the above troubles the parts to be serviced are

- Water pump
- Thermostat valve
- Radiator
- Tension of Fan belt etc

Thermostat valve: The Thermostat valve is designed to start opening at a particular temperature and to be fully opened at another higher temperature.

The thermostats intended for use in cooling system Alcohol as an antifreeze usually are intended to start opening at 148 to 155 ^{0} F and are wide open at 173 ^{0} F. If there is any difference in the opening temperature of Thermostat, replace it.

Water Pump: Servicing of Water Pump is cleaning, proper alignment of impeller etc. The impeller needs to be replaced if required.

Radiator: The Radiator is needed to be checked for its proper alignment of cores and Fins.

Transmission:

Clutch Overhaul

A general procedure for clutch overhaul has been explained the following procedure.

1. **Removing the Clutch** : The exact procedure to be followed for removing the clutch depends upon the particular make of the car and the instruction manual for the same must be consulted. However the general procedure may be outlined as follows:

a) Remove the gearbox from the chassis including various clutch and gearbox linkages.

b) The clutch assembly is separated from the engine by removing the flywheel screws.

2. Disassembling:

a) Before starting dismantling the clutch cover assembly, it is very important to mark the relative positions of various components so that they can be reassembled easily.
b) Place the cover assembly under a press, with wooden blocks and apply pressure by hand to cover and remove the three adjusting nuts. Release the pressure gradually till the clutch springs are completely free.
c) Lift off the cover to inspect various parts inside.
d) If it is required to remove the other components.

3.Cleaning & Inspection:

a) Now clean the dismantled parts of the clutch with kerosene.
b) Inspect the clutch facing for wear. Incase it is worn out up to the rivets heads, replace with new one.
c) Inspect the cushioning and torsional springs on the clutch plate. Incase they are found to be cracked or weak, complete plate has to be replaced.
d) Check the pressure springs for stiffness. If variation incase of a particular spring from the original value is more than the allowable, the same should be replaced.
e) Clean and grease the thrown out bearing. Now hold the inner race and try to rotate the outer race keeping it under pressure. If the rotation is not uniform the bearing needs replacement.
f) Check the pressure plate, it should have a smooth plane surface. Incase it is distorted by more than 0.3 mm, or is badly scored, replace it.

4. Assembly:

a) Grease various clutch components requiring lubrication before reassembling.
b) Place the pressure plate on the blocks placed over the press bed and place pressure springs on it at suitable places.
c) Fit also the release levers and place the cover over the assemble parts.
d) Apply pressure gradually taking care that the bolts are guided properly through the holes in the cover.
e) Then tighten the nuts in proper order and with the correct maximum torque. Remove the pressure by releasing press.

5 Refitting the Clutch:

a) Attach the clutch cover assembly to the fly wheel by means of bolts, placing the clutch plate in between the fly wheel and correct assembly.

b) Make sure that the clutch plate is centralized. This may be done by using a clutch alignment bar.
c) Refit the gear box at the proper place on the vehicle chassis.
d) Refit the clutch operating linkages and lubricate to the linkages.

6 Clutch Adjustment:

Although the clutch is fitted and set very accurately on the initial assembly of the vehicle, however it requires some adjustments. Usually following adjustments are made on most of the clutches;

a) **Free Pedal Play Adjustment**: This adjustment is required to keep a specified amount of free play in the pedal after the clutch has been engaged. This adjustment is made by changing the length of one rod located some where in the clutch linkage. It should be made only after the correct floor board clearance or clutch pedal travel has been made. If no free play is kept is ay result is noise and damage to release bearing and also slopping of clutch. In light vehicles, it is kept between 15 mm to 25 mm, in heavy vehicle, it is kept between 30 and 35 mm.
b) **Clutch Release Leaver Adjustment**: This adjustment should be made every time the clutch is removed from the vehicle. By making this adjustment to manufacturer's specification, a clutch rebuilding machine equipped with a dial gauge or a gauge plate is used.

Overhauling of Gear Box

Transmission construction varies considerably from car to car. Therefore, removal and servicing procedures also vary. Before, attempting to disassemble a manual transmission , carefully study both the transmission and the transmission section in the manufacturer's service manual. Follow the procedures for removing, disassembly, service, and reassembly.

1. Remove the transmission from the cross members with the help of jack if available. If a jack in not available, get another person to help you. The gearbox top cover with selector mechanism and gearbox front end and rear cover are removed.
2. Remove the primary shaft with bearing by slightly tapping it from the inside the casing. Remove the lock retaining the lay shaft.
3. Pull out the main shaft completely within the synchromesh assembly and gear wheels etc., are carefully remove without allowing the synchromesh balls and springs to fall down.
4. Remove the lay shaft from the front end with hammer and drift. Remove the lay shaft gears assembly carefully.
5. Hold the primary shaft in a vice and remove the bearing retainer lock ring.

6. Remove the bearing from the primary shaft with the press.
7. Remove the reverse idler spindle and the reverse gear wheel.
8. Clean the all parts with kerosene and dry with compressed air.
9. Examine the gear teeth very carefully. Gears with cracked or chipped teeth or badly worn edges should be replaced.
10. Examine roller bearing for wear and pitting. Replace badly worn as they become noisy and can cause damage to the gears.
11. Replace worn or bent selector forks.
12. Assemble the gear box parts with respective place and adjust the selector mechanism. When reassembling the parts gears must be kept in neutral.

Overhauling of propeller shaft: Check the propeller shaft, U-joints and slip joint for their proper alignment. Replace universal joints if necessary.

Servicing of Ignition System:

Strength of the spark: Run the engine at idle speed. Remove the high tension lead from No.1 spark plug and hold the wire terminal 3/16 inches from the cylinder head and observe if the spark jumps the gap regularly with out missing. Make the test at each spark plug. Rectify the trouble of weak spark if required.

Adjusting of ignition timing if most essential in servicing ignition. Check, clean, and adjust the other parts like distributor, condenser, contact breaker points etc.,

Servicing of Steering System:

Servicing of steering system includes adjusting of backlash in steering gear, maintenance of steering gear, adjustment of king pin inclination, toe in, cater angle, camber angle etc.,

Repair and servicing of Brakes:

Any complain of faulty breaking action should be analyzed to determine the cause. Break service include addition of break fluid, bleeding the hydraulic system, repair of master cylinder, replacement of brake linings and overhauling of wheel cylinder.

Servicing of Brake shoe assembly:

1. Remove the vehicle so that all the four wheels are free
2. Remove the wheels, hubs and drums which will give access to the break shoes.
3. The brake shoe retaining spring is removed.
4. Remove the brake shoe pivot and washer.
5. Brake shoes are removed after twisting a locking wire around the wheel cylinder to retain the pistons in position.
6. The complete unit of wheels cylinder is removed.

7. Examine the back plate for any defect.
8. The brake drum is examined for wear and score and it has to be turned on a brake drum lathe, if necessary. Then install correct oversize lining or shoe.
9. Examine the brake shoe lining for wear and damage.
10. Install the brake shoe assembly and adjust for proper working.

Overhauling of Master Cylinder:

1. Thoroughly clean the out side of the Master cylinder, then drain the brake fluid.
2. Pull out the piston, spring and valve, remove primary and secondary cups.
3. After dismantling the master cylinder clean all the parts in alcohol and dry it with compressed air.
4. Then clean all the parts with fresh brake fluid and assemble the master cylinder.

Overhauling of Wheel Cylinder:

1. Remove the wheel and brake drum.
2. Disconnect the brake hose from the wheel cylinder.
3. Remove the wheel cylinder.
4. Remove the piston cups and springs.
5. Wash all the parts in alcohol and brake fluid.
6. Inspect, replace if necessary.

Bleeding of Brakes:

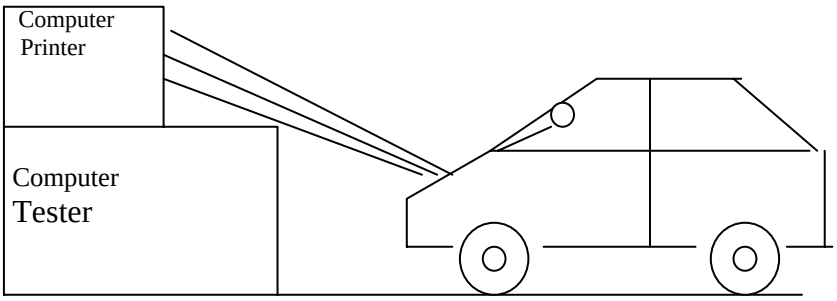
1. Attach the bleeder tube to the bleeder valve of wheel cylinder.
2. Keep the other end of the pipe in glass bottle.
3. For bleeding, press the brake pedal 4 to 5 times and keep it pressed. Now un-screw the bleeding screw of wheel cylinder.
4. You can see the brake fluid and air bubbles coming out of the wheel cylinder.
5. Keep the bleeding screw open until the air bubbles disappear and the brake fluid coming out of it with a force.
6. Then tighten the bleeding screw.
7. Repeat the process on all the wheel cylinders.
8. Particularly the bleeding should be done starting from the farthest wheel at first and the nearest wheel at last to the brake pedal.

Servicing of Suspension:

It includes maintenance of leaf springs, shock absorbers , torsion bars, coil springs etc., For maintenance of leaf springs the tension of each leaf should be maintained properly. Broken leaf should be replaced if necessary. The shackles also should be replaced.

The shock absorbers should be repaired only once in their life time otherwise they should be replaced.

Engine Analyzer:



Engine Analyzer

It is used to measure the battery voltage, cranking voltage and current, charging voltage and current, coil condition, dwell angle and advance angles, Power balance, rpm of the engine, compression ratio etc.,

Alignment of wheels: The first step of wheel alignment is correct inflation of tyres with recommended pressures. Next step is determination of traveling of front wheels at straight ahead position. For this purpose the following are the steps.

1. Inflate tyres
2. Check wheel bearings
3. Check ball joint and suspension arm bushings
4. Check the tie rod and draglink ends
5. Checking of steering gear mountings
6. Checking of shock absorbers

Technical Specifications of Cars & Jeeps

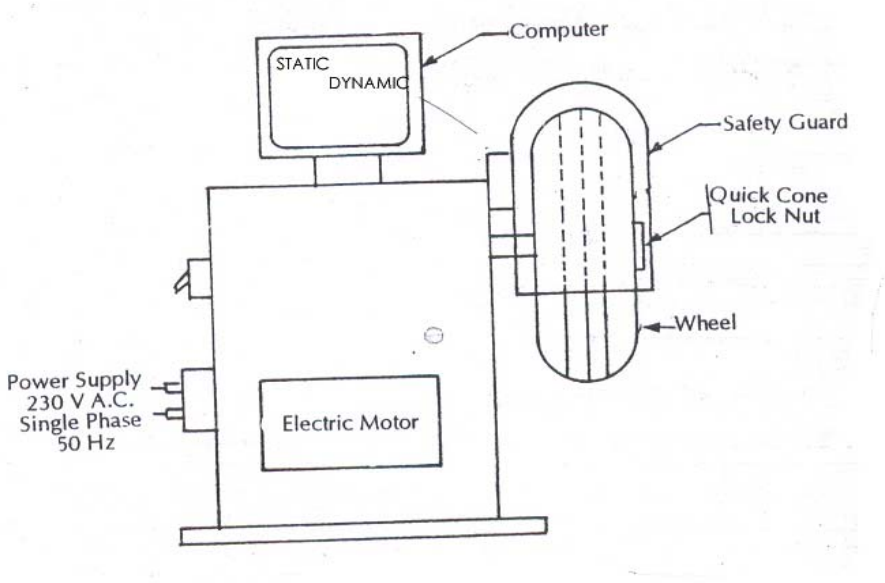
Model	Engine displacement No. of Cylinder(CC)	Power (h.p)	Compression Ratio	Transmission	Steering	Suspension	Fuel average KML
1. Bajaj Tempo (Trax, Challenger ,Town & Country	2400/4 Diesel	65 at 4000 rpm	21 : 1	Manual 4 Speed rear wheel driver	Rack and pinion	Independent front with anti roll bar & torsion bar, leaf spring	12 kmpl

						with antiroll bar with rear	
Mahindra Commander 650 DI	2112/4 Diesel	62 at 4500rpm	22.4 : 1	Manual 4 Speed RWD	Recurculating ball type	Leaf spring at front and rear	11.5 kmpl
Ambassdor Nova 1800 ISZ	1817/4 Petrol	74 at 5000rpm	8.5 : 1	Manual 5 Speed RWD	Rack and pinion	Wishbone at front & leaf spring at rear	10 kmpl
Contessa	1995/4 Diesel	52 at 4500rpm	21 : 1	Manual 5 Speed RWD	Rack and pinion	Macpherson struts at front multi link unit with coil springs at the rear	12 kmpl
Maruti 800	796/3 Petrol	39.5 at 5000rpm	8.7 : 1	Manual 4 Speed FWD	Rack & Pinion	Macpherson strut and coil spring at front,leaf spring at the rear	14 kmpl
Maruti Gypsy	970/4 Petrol	45 at 5500rpm	8.8 : 1	Manual 4 speed Rear/4 wheel drive	Recirculating ball & nut	Leaf springs and dampers front and rear. Anti roll bar at front spring	11 kmpl
Maruti Zen	993/4 Petrol	50 at 6500rpm	8.8 : 1	Manual 5 speed FWD(3 speed automatic)	Rack & Pinion	Macpherson struts at front, 3 link isolated trailing arm at rear	13.5kmpl(10.5 for automatic)
Premier 118DE	1171/4 Petrol	52 at 5600rpm	9 : 1	Manual 4 speed RWD	Worm and roller	Wishbone & dampers at front, leaf springs at the rear	11 kmpl

Fait UNO	999/4 Petrol	45 at 5600rpm	8.8 : 1	Manual 5 Speed FWD	Rack & Pinion	Macpherson strut at front, rear torsion with longitudinal tubular arm	12 kmpl
Tata Sumo	1948/4 Diesel	68 at 4500rpm	22.5 : 1	Manual 5 speed RWD	Rack & Pinion Power assisted	Double wishbone at front, coil springs at the rear, anti roll bars front and rear	13 kmpl

Balancing of Wheels:

Using a wheel spinner spin each front wheel in turn. A wheel that is out of balance will cause the front of the vehicle to shake. For checking the rear wheel, jack up the vehicle and drive the raised wheel in high gear. After checking balancing the wheels by wheel balancer.



COMPUTERISED WHEEL BALANCER

LIST OF REFERENCE BOOKS

1. Automobile Engineering by R.B.Gupta
2. Automobile Engineering by G.B.S. Narang
3. Automobile Servicing and Maintenance by K.Ashrif Ali
4. Automotive Maintenance and Trouble Shooting by Ernest Venk, & Edward D. Spicer